fumigation. The vented fruit containers are stacked in a purpose-built fumigation chamber of a fumigation facility and the fruit fumigated with a gaseous fumigant. The fruit containers are then transported out of the fumigation facility either to a cold storage area of a packing house or directly to shipment vehicles.

Summary of the Invention

According to one aspect of the present invention there is provided a fumigation apparatus including:

a conventional shipping container which at least in part defines a fumigation chamber being adapted to contain produce to be fumigated, and

mobile fumigation means operatively coupled to the conventional shipping container, the mobile fumigation means including:

fumigant inlet means operatively coupled to the container to allow a flow of a fumigant into the fumigation chamber;

extraction means also being operatively coupled to the container to remove a majority of the fumigant from the fumigation chamber; and

absorption means being operatively coupled to the extraction means, the absorption means being designed to absorb substantially all of the fumigant extracted from the fumigation chamber.

Preferably the mobile fumigation means is defined by a shipping container. Typically the fumigation chamber is a pair of shipping containers positioned alongside one another each operatively coupled to the mobile fumigation means. Alternatively the mobile fumigation means is defined by a partition wall in the shipping container, the wall separating the mobile fumigation means and the fumigation chamber.

Preferably the fumigation apparatus further includes control means operatively coupled to the shipping container and arranged to control the flow of fumigant into the

container. Typically the mobile fumigation means is a control room in which the control means is located.

Preferably the partition wall and/or the shipping container fumigation chamber itself is secure against the passage of the fumigant. This means that toxic gases from the process in the fumigation chamber will not pose any occupational health risk to operators of the fumigation apparatus during processing, while they may be standing in the adjacent control room. It also provides an all weather secure location for associated control equipment.

Preferably the absorption means comprises an absorption bed including activated carbon to which at least part of the extracted fumigant attaches.

Typically the fumigation apparatus also comprises a sliding bed or floor on which the produce resides, said bed or floor being configured to slide into and out of the fumigation chamber wherein loading and unloading of the produce to be fumigated can be performed externally of said chamber.

Preferably the control room incorporates a source of the fumigant which is preferably directly associated with a heating source, the latter used to convert the fumigant into a gaseous form. The heat energy transferred to the fumigant should be such that it becomes more buoyant than ambient air. In another variant the fumigation apparatus has a source of the fumigant and a heating source which are contained in an appropriate storage box which is secure against the passage of gases. Alternatively the fumigant inlet means is adapted to detachably couple to a mobile source of the fumigant such as a motor vehicle on which a fumigant vessel is mounted.

Preferably the control room incorporates a system control box and a system of fumigant delivery pipes and valves adapted in use to supply fumigant from the supply source to the fumigation chamber.

Preferably the fumigation chamber has openable doors

in the container, the end doors when closed being secure against the passage of fumigant and further being fitted with external locking cam devices adapted to be secured with a latch and pin arrangement. More preferably the sliding bed or floor of the fumigation apparatus facilitates loading and removal of produce for fumigation via the end doors.

Preferably the fumigant inlet means includes a dispersion pipe system located in the upper part of the fumigation chamber. Such an arrangement allows the fumigant, which is generally heavier than air, to fall in a dispersed fashion downward over the top of the produce such as the timber and dunnage charge which has been loaded into the fumigation chamber.

Preferably the fumigation chamber is provided with a plurality of mixing fans adapted to circulate fumigant and gases within the chamber. Such an arrangement allows more even and thorough dispersion of the fumigant and gases as they enter and are dispersed in the fumigation chamber.

Preferably the extraction means includes a pipe attached to an orifice located in a lower region of a partition or a container wall, the pipe being connected in turn to an actuated butterfly valve further connected in turn to a contra-rotating fan adapted to provide suction for the extraction of the fumigant. More preferably the extraction means includes an exhaust stack positioned vertically above the fumigation container, the uppermost terminal of the exhaust stack being fitted with a gas diffuser and appropriate rain guard, and the exhaust stack being arranged to receive the stripped fumigant stream.

Preferably the fumigation chamber contains a plurality of small diameter floor and wall-mounted pipes independently connected via an appropriate system of taps and connectors to a fumigant sampling and detection meter unit located in the control room. More preferably the floor and wall-mounted pipes may be further adapted to be

located in recessed grooves which may form part of the construction of the walls or floor of the container.

Preferably the control room includes a system control box which contains the fumigant sampling and detection meter unit and power supply switches for mixing fans, exhaust fan, lights, gas heaters and valve actuators.

In the preferred embodiment of the invention the fumigation apparatus is constructed using at least one conventional shipping container. Such a container is in all respects suitable for handling and use in the wharf or port vicinity. In fact, if available, effective fumigation of dunnage on site at the wharf by skilled operators would allow for the safe treatment and removal of this material for re-use as firewood or for building purposes, would eliminate the possibility of insects or vermin escaping into the environment, would speed up the fumigation processing rate and would provide some enhanced health and safety benefits.

According to another aspect of the invention there is provided a method of fumigating produce, the method comprising the steps of:

providing a fumigation apparatus including a conventional shipping container which at least in part defines a fumigation chamber and a mobile fumigation means operatively coupled to the container;

locating the produce to be fumigated in the fumigation chamber;

providing a flow of a fumigant to the fumigation chamber;

extracting at least some of the fumigation from the chamber; and

absorbing at least part of the fumigant extracted from the fumigation chamber.

Preferably the fumigant extracted from the chamber is absorbed on an absorption bed.

Typically the method of fumigating produce further

comprises washing at least part of the absorption bed to remove the absorbed fumigant. More typically the absorption bed is washed with a scrubbing solution, such as sodium thiosulphate, to yield one or more salts, such as bromide and sodium methylthiosulphate.

The claims defining the invention are as follows:

1. A fumigation apparatus including:

a conventional shipping container which at least in part defines a fumigation chamber being adapted to contain produce to be fumigated, and

mobile fumigation means operatively coupled to the conventional shipping container, the mobile fumigation means including:

fumigant inlet means operatively coupled to the container to allow a flow of a fumigant into the fumigation chamber;

extraction means also being operatively coupled to the container to remove a majority of the fumigant from the fumigation chamber; and

absorption means being operatively coupled to the extraction means, the absorption means being designed to absorb substantially all of the fumigant extracted from the fumigation chamber.

2. A fumigation apparatus as defined in claim 1 wherein the mobile fumigation means is defined by a shipping container.

3. A fumigation apparatus as defined in claim 1 or 2 wherein the fumigation chamber is a pair of shipping containers positioned alongside one another each operatively coupled to the mobile fumigation means.

4. A fumigation apparatus as defined in claim 1 wherein the mobile fumigation means is defined by a partition wall in the shipping container, the wall separating the mobile fumigation means and the fumigation chamber.

5. A fumigation apparatus as defined in any one of the preceding claims wherein the absorption means comprises an absorption bed including activated carbon to which at least part of the extracted fumigant attaches.

6. A fumigation apparatus as defined in any one of the preceding claims also including a sliding bed or floor on which the produce resides, the bed or floor being configured to slide into and out of the fumigation chamber wherein loading and unloading of the produce to be fumigated can be performed externally of the chamber.

7. A fumigation apparatus as defined in any one of the preceding claims wherein the mobile fumigation means incorporates a source of the fumigant which is directly associated with a heating source, the latter used to convert the fumigant into a gaseous form.

8. A fumigation apparatus as defined in any one of claims 1 to 6 wherein the fumigant inlet means is adapted to detachably couple to a mobile source of the fumigant.

9. A fumigation apparatus as defined in any one of the preceding claims wherein the mobile fumigation means incorporates a system control box and a system of fumigant delivery pipes and valves adapted in use to supply fumigant from a supply source to the fumigation chamber.

10. A fumigation apparatus as defined in any one of the preceding claims wherein the fumigant inlet means includes a dispersion pipe system located in the upper part of the fumigation chamber.

11. A fumigation apparatus as defined in any one of the preceding claims wherein the fumigation chamber contains a plurality of small diameter floor and wall-mounted pipes independently connected via an appropriate system of taps and connectors to a fumigant sampling and detection meter unit located in the control room.

12. A fumigation apparatus as defined in claims 9 to 11 wherein the system control box contains a fumigant sampling and detection meter unit and power supply switches for mixing fans, exhaust fan, lights, gas heaters and valve actuators.

13. A method of fumigating produce, the method comprising the steps of:

providing a fumigation apparatus including a conventional shipping container which at least in part defines a fumigation chamber and a mobile fumigation means operatively coupled to the container;

locating the produce to be fumigated in the fumigation chamber;

providing a flow of a fumigant to the fumigation chamber;

extracting at least some of the fumigation from the chamber; and

absorbing at least part of the fumigant extracted from the fumigation chamber.

14. A method of fumigating produce as defined in claim 13 wherein the fumigant extracted from the chamber is absorbed on an absorption bed.

15. A method of fumigating produce as defined in claim 13 or 14 further comprising washing at least part of the absorption bed to remove the absorbed fumigant.

5

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

14 15

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference FP12653	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International Application No. **PCT/AU00/00336**	International Filing Date *(day/month/year)* 19 April 2000	Priority Date *(day/month/year)* 20 April 1999
International Patent Classification (IPC) or national classification and IPC **Int. Cl.** [7] A01M 13/00, B65D 88/74		
Applicant AUSTRALIAN SHIPPING LOGISTICS PTY LTD et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

 [X] This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

 These annexes consist of a total of **9** sheet(s).

3. This report contains indications relating to the following items:

CORRECTED VERSION

- I [X] Basis of the report
- II [] Priority
- III [] Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV [] Lack of unity of invention
- V [X] Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI [] Certain documents cited
- VII [] Certain defects in the international application
- VIII [] Certain observations on the international application

Date of submission of the demand 20 November 2000	Date of completion of the report 11 May 2001
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer **A. SEN** Telephone No. (02) 6283 2158

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/AU00/00336

I. Basis of the report

1. With regard to the **elements** of the international application:*

☐ the international application as originally filed.

☒ the description, pages **1, 6-11,** as originally filed,
pages **2,** received on **2 May 2001** with the letter of **5 April 2001**
pages **3-5, 5A,** received on **30 January 2001** with the letter of **30 January 2001**

☒ the claims, pages , as originally filed,
pages , as amended (together with any statement) under Article 19,
pages **12,** received on **2 May 2001** with the letter of **5 April 2001,**
pages **13-15,** received on **30 January 2001** with the letter of **30 January 2001**

☒ the drawings, pages **1/3-3/3,** as originally filed,
pages , filed with the demand,
pages , received on with the letter of

☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, was on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages

☐ the claims, Nos.

☐ the drawings, sheets/fig.

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report*

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-15	YES
	Claims		NO
Inventive step (IS)	Claims	1-15	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-15	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Claims 1-15 meet the criteria set forth in PCT Article 33(2)-33(4) for novelty, inventive step and industrial applicability. The prior art published before the priority date does not disclose a fumigation apparatus consisting of a conventional shipping container defining a fumigation chamber and a mobile fumigation means coupled to the container and including a fumigant inlet means, an extraction means and an absorption means.

fumigation. The vented fruit containers are stacked in a purpose-built fumigation chamber of a fumigation facility and the fruit fumigated with a gaseous fumigant. The fruit containers are then transported out of the fumigation facility either to a cold storage area of a packing house or directly to shipment vehicles.

Summary of the Invention

According to one aspect of the present invention there is provided a fumigation apparatus including:

a conventional shipping container which at least in part defines a fumigation chamber being adapted to contain produce to be fumigated, and

mobile fumigation means operatively coupled to the conventional shipping container, the mobile fumigation means including:

fumigant inlet means operatively coupled to the container to allow a flow of a fumigant into the fumigation chamber;

extraction means also being operatively coupled to the container to remove a majority of the fumigant from the fumigation chamber; and

absorption means being operatively coupled to the extraction means, the absorption means being designed to absorb substantially all of the fumigant extracted from the fumigation chamber.

Preferably the mobile fumigation means is defined by a shipping container. Typically the fumigation chamber is a pair of shipping containers positioned alongside one another each operatively coupled to the mobile fumigation means. Alternatively the mobile fumigation means is defined by a partition wall in the shipping container, the wall separating the mobile fumigation means and the fumigation chamber.

Preferably the fumigation apparatus further includes control means operatively coupled to the shipping container and arranged to control the flow of fumigant into the

PCT/AU00/00336
Received 30 January 2001

container. Typically the mobile fumigation means is a control room in which the control means is located.

Preferably the partition wall and/or the shipping container fumigation chamber itself is secure against the passage of the fumigant. This means that toxic gases from the process in the fumigation chamber will not pose any occupational health risk to operators of the fumigation apparatus during processing, while they may be standing in the adjacent control room. It also provides an all weather secure location for associated control equipment.

Preferably the absorption means comprises an absorption bed including activated carbon to which at least part of the extracted fumigant attaches.

Typically the fumigation apparatus also comprises a sliding bed or floor on which the produce resides, said bed or floor being configured to slide into and out of the fumigation chamber wherein loading and unloading of the produce to be fumigated can be performed externally of said chamber.

Preferably the control room incorporates a source of the fumigant which is preferably directly associated with a heating source, the latter used to convert the fumigant into a gaseous form. The heat energy transferred to the fumigant should be such that it becomes more buoyant than ambient air. In another variant the fumigation apparatus has a source of the fumigant and a heating source which are contained in an appropriate storage box which is secure against the passage of gases. Alternatively the fumigant inlet means is adapted to detachably couple to a mobile source of the fumigant such as a motor vehicle on which a fumigant vessel is mounted.

Preferably the control room incorporates a system control box and a system of fumigant delivery pipes and valves adapted in use to supply fumigant from the supply source to the fumigation chamber.

Preferably the fumigation chamber has openable doors

PCT/AU00/00336
Received 30 January 2001

in the container, the end doors when closed being secure against the passage of fumigant and further being fitted with external locking cam devices adapted to be secured with a latch and pin arrangement. More preferably the sliding bed or floor of the fumigation apparatus facilitates loading and removal of produce for fumigation via the end doors.

Preferably the fumigant inlet means includes a dispersion pipe system located in the upper part of the fumigation chamber. Such an arrangement allows the fumigant, which is generally heavier than air, to fall in a dispersed fashion downward over the top of the produce such as the timber and dunnage charge which has been loaded into the fumigation chamber.

Preferably the fumigation chamber is provided with a plurality of mixing fans adapted to circulate fumigant and gases within the chamber. Such an arrangement allows more even and thorough dispersion of the fumigant and gases as they enter and are dispersed in the fumigation chamber.

Preferably the extraction means includes a pipe attached to an orifice located in a lower region of a partition or a container wall, the pipe being connected in turn to an actuated butterfly valve further connected in turn to a contra-rotating fan adapted to provide suction for the extraction of the fumigant. More preferably the extraction means includes an exhaust stack positioned vertically above the fumigation container, the uppermost terminal of the exhaust stack being fitted with a gas diffuser and appropriate rain guard, and the exhaust stack being arranged to receive the stripped fumigant stream.

Preferably the fumigation chamber contains a plurality of small diameter floor and wall-mounted pipes independently connected via an appropriate system of taps and connectors to a fumigant sampling and detection meter unit located in the control room. More preferably the floor and wall-mounted pipes may be further adapted to be

PCT/AU00/00336
Received 30 January 2001

located in recessed grooves which may form part of the construction of the walls or floor of the container.

Preferably the control room includes a system control box which contains the fumigant sampling and detection meter unit and power supply switches for mixing fans, exhaust fan, lights, gas heaters and valve actuators.

In the preferred embodiment of the invention the fumigation apparatus is constructed using at least one conventional shipping container. Such a container is in all respects suitable for handling and use in the wharf or port vicinity. In fact, if available, effective fumigation of dunnage on site at the wharf by skilled operators would allow for the safe treatment and removal of this material for re-use as firewood or for building purposes, would eliminate the possibility of insects or vermin escaping into the environment, would speed up the fumigation processing rate and would provide some enhanced health and safety benefits.

According to another aspect of the invention there is provided a method of fumigating produce, the method comprising the steps of:

providing a fumigation apparatus including a conventional shipping container which at least in part defines a fumigation chamber and a mobile fumigation means operatively coupled to the container;

locating the produce to be fumigated in the fumigation chamber;

providing a flow of a fumigant to the fumigation chamber;

extracting at least some of the fumigation from the chamber; and

absorbing at least part of the fumigant extracted from the fumigation chamber.

Preferably the fumigant extracted from the chamber is absorbed on an absorption bed.

Typically the method of fumigating produce further

PCT/AU00/00336
Received 30 January 2001

comprises washing at least part of the absorption bed to remove the absorbed fumigant. More typically the absorption bed is washed with a scrubbing solution, such as sodium thiosulphate, to yield one or more salts, such as bromide and sodium methylthiosulphate.

The claims defining the invention are as follows:

1. A fumigation apparatus including:

a conventional shipping container which at least in part defines a fumigation chamber being adapted to contain produce to be fumigated, and

mobile fumigation means operatively coupled to the conventional shipping container, the mobile fumigation means including:

fumigant inlet means operatively coupled to the container to allow a flow of a fumigant into the fumigation chamber;

extraction means also being operatively coupled to the container to remove a majority of the fumigant from the fumigation chamber; and

absorption means being operatively coupled to the extraction means, the absorption means being designed to absorb substantially all of the fumigant extracted from the fumigation chamber.

2. A fumigation apparatus as defined in claim 1 wherein the mobile fumigation means is defined by a shipping container.

3. A fumigation apparatus as defined in claim 1 or 2 wherein the fumigation chamber is a pair of shipping containers positioned alongside one another each operatively coupled to the mobile fumigation means.

4. A fumigation apparatus as defined in claim 1 wherein the mobile fumigation means is defined by a partition wall in the shipping container, the wall separating the mobile fumigation means and the fumigation chamber.

5. A fumigation apparatus as defined in any one of the preceding claims wherein the absorption means comprises an absorption bed including activated carbon to which at least part of the extracted fumigant attaches.

6. A fumigation apparatus as defined in any one of the preceding claims also including a sliding bed or floor on which the produce resides, the bed or floor being configured to slide into and out of the fumigation chamber wherein loading and unloading of the produce to be fumigated can be performed externally of the chamber.

7. A fumigation apparatus as defined in any one of the preceding claims wherein the mobile fumigation means incorporates a source of the fumigant which is directly associated with a heating source, the latter used to convert the fumigant into a gaseous form.

8. A fumigation apparatus as defined in any one of claims 1 to 6 wherein the fumigant inlet means is adapted to detachably couple to a mobile source of the fumigant.

9. A fumigation apparatus as defined in any one of the preceding claims wherein the mobile fumigation means incorporates a system control box and a system of fumigant delivery pipes and valves adapted in use to supply fumigant from a supply source to the fumigation chamber.

10. A fumigation apparatus as defined in any one of the preceding claims wherein the fumigant inlet means includes a dispersion pipe system located in the upper part of the fumigation chamber.

11. A fumigation apparatus as defined in any one of the preceding claims wherein the fumigation chamber contains a plurality of small diameter floor and wall-mounted pipes independently connected via an appropriate system of taps and connectors to a fumigant sampling and detection meter unit located in the control room.

12. A fumigation apparatus as defined in claims 9 to 11 wherein the system control box contains a fumigant sampling and detection meter unit and power supply switches for mixing fans, exhaust fan, lights, gas heaters and valve actuators.

13. A method of fumigating produce, the method comprising the steps of:

providing a fumigation apparatus including a conventional shipping container which at least in part defines a fumigation chamber and a mobile fumigation means operatively coupled to the container;

locating the produce to be fumigated in the fumigation chamber;

providing a flow of a fumigant to the fumigation chamber;

extracting at least some of the fumigation from the chamber; and

absorbing at least part of the fumigant extracted from the fumigation chamber.

14. A method of fumigating produce as defined in claim 13 wherein the fumigant extracted from the chamber is absorbed on an absorption bed.

15. A method of fumigating produce as defined in claim 13 or 14 further comprising washing at least part of the absorption bed to remove the absorbed fumigant.

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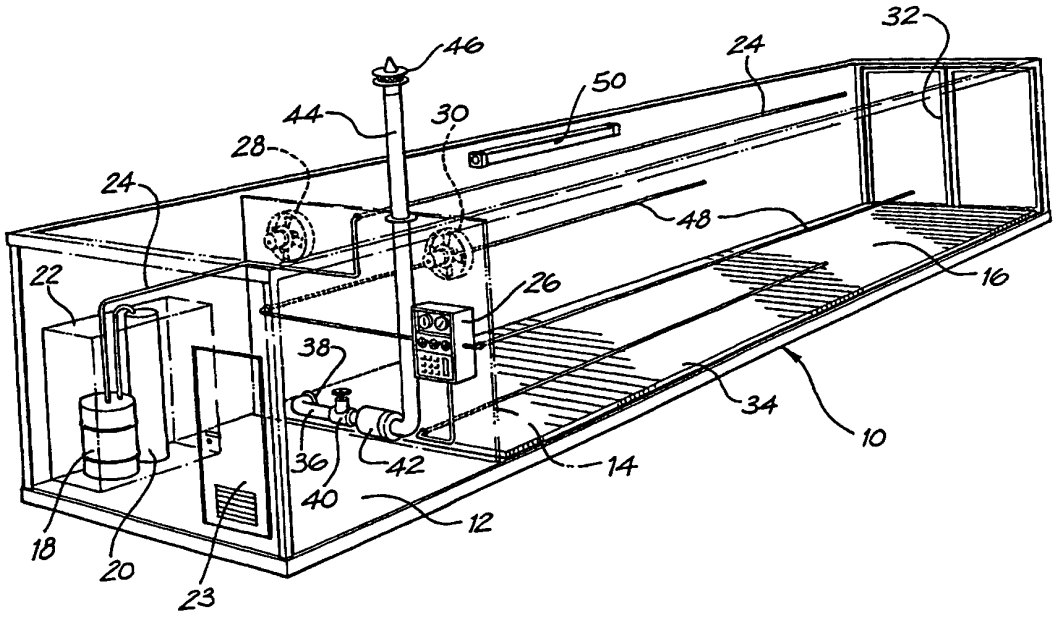
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Published
With international search report.

(54) Title: FUMIGATION APPARATUS



(57) Abstract

A fumigation apparatus including: (a) a conventional shipping container (10); (b) a partition (14) dividing the container into a fumigation chamber (16) and a control room (12); (c) means (24) arranged to supply gas into the fumigation chamber (16); (d) control means (26) located in the control room arranged to control the flow of gas into the fumigating chamber (16) and (e) extraction means (36, 38, 40, 42, 44) arranged to remove gas from the fumigation chamber as controlled from the system control box (26).

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UZ	Uzbekistan
VN	Viet Nam
YU	Yugoslavia
ZW	Zimbabwe

Fumigation Apparatus

Field of the Invention

The present invention relates generally to a fumigation apparatus. The invention will primarily be described with reference to its use to provide fumigation of timber dunnage and other waste shipping cargo packaging material, but it should be realised that the invention can have broader applications to any other bulk materials, goods or produce which may contain pests or insects or other vermin and which therefore require fumigation.

Background to the Invention

Large quantities of timber and packing materials are carried all over the world in ships and such goods remain largely useless at the point of arrival of the ship due to the likelihood of it containing pests, parasites, insects or other vermin from another country, such as for example borers, lice, ticks, fleas or termites. It is best that the timber dunnage and other bulk materials do not have to leave the confines of the wharf or port vicinity to travel to a distant site for effective treatment, since this would pose an environmental exposure risk.

Fumigation devices for bulk materials are known in the art that involve placement of a heavy, impervious blanket or other covering article over the materials followed by subsequent addition of toxic gas flow under the blanket to fumigate the covered goods. Current methods of fumigation under blankets are crude, ineffective at fully eliminating insect infestation since no mixing of gases with dunnage can occur, and highly dangerous from an occupational health standpoint since the gases used for effective fumigation are extremely toxic.

US patent No. 5,318,789 relates generally to a method for fumigating produce and in particular fruit. US 5,318,789 describes the specific construction of a vented container in which the fruit is packed in preparation for

fumigation. The vented fruit containers are stacked in a purpose-built fumigation chamber of a fumigation facility and the fruit fumigated with a gaseous fumigant. The fruit containers are then transported out of the fumigation facility either to a cold storage area of a packing house or directly to shipment vehicles.

Summary of the Invention

According to one aspect of the present invention there is provided a fumigation apparatus comprising:

a conventional shipping container which at least in part defines a fumigation chamber being adapted to contain produce to be fumigated;

fumigant inlet means operatively coupled to the container to allow a flow of a fumigant into the fumigation chamber; and

extraction means also being operatively coupled to the container to remove a majority of the fumigant from the fumigation chamber.

Preferably the fumigation apparatus further comprises control means operatively coupled to the shipping container and arranged to control the flow of fumigant into said container.

Typically the fumigation apparatus also comprises another conventional shipping container positioned alongside the shipping container and providing a control room in which the control means is located. Alternatively the fumigation apparatus further comprises a partition wall dividing the shipping container into the fumigation chamber and a control room in which the control means is located.

Preferably the partition wall and/or the shipping container itself is secure against the passage of the fumigant. This means that toxic gases from the process in the fumigation chamber will not pose any occupational health risk to operators of the fumigation apparatus during processing, while they may be standing in the control room. It also provides an all weather secure location for

associated control equipment.

Preferably the fumigation apparatus further comprises absorption means operatively coupled to the extraction means, said absorption means being designed to absorb at least part of the fumigant extracted from the fumigation chamber. More preferably said absorption means comprises an absorption bed including activated carbon to which at least part of the extracted fumigant attaches.

Typically the fumigation apparatus also comprises a sliding bed or floor on which the produce resides, said bed or floor being configured to slide into and out of the fumigation chamber wherein loading and unloading of the produce to be fumigated can be performed externally of said chamber.

Preferably the control room incorporates a source of the fumigant which is preferably directly associated with a heating source, the latter used to convert the fumigant into a gaseous form. The heat energy transferred to the fumigant should be such that it becomes more buoyant than ambient air. In another variant the fumigation apparatus has a source of the fumigant and a heating source which are contained in an appropriate storage box which is secure against the passage of gases. Alternatively the fumigant inlet means is adapted to detachably couple to a mobile source of the fumigant such as a motor vehicle on which a fumigant vessel is mounted.

Preferably the control room incorporates a system control box and a system of fumigant delivery pipes and valves adapted in use to supply fumigant from the supply source to the fumigation chamber.

Preferably the fumigation chamber has openable doors in the container, the end doors when closed being secure against the passage of fumigant and further being fitted with external locking cam devices adapted to be secured with a latch and pin arrangement. More preferably the sliding bed or floor of the fumigation apparatus

facilitates loading and removal of produce for fumigation via the end doors.

Preferably the fumigant inlet means includes a dispersion pipe system located in the upper part of the fumigation chamber. Such an arrangement allows the fumigant, which is generally heavier than air, to fall in a dispersed fashion downward over the top of the produce such as the timber and dunnage charge which has been loaded into the fumigation chamber.

Preferably the fumigation chamber is provided with a plurality of mixing fans adapted to circulate fumigant and gases within the chamber. Such an arrangement allows more even and thorough dispersion of the fumigant and gases as they enter and are dispersed in the fumigation chamber.

Preferably the extraction means includes a pipe attached to an orifice located in a lower region of a partition or a container wall, the pipe being connected in turn to an actuated butterfly valve further connected in turn to a contra-rotating fan adapted to provide suction for the extraction of the fumigant. More preferably the extraction means includes an exhaust stack positioned vertically above the fumigation container, the uppermost terminal of the exhaust stack being fitted with a gas diffuser and appropriate rain guard, and the exhaust stack being arranged to receive the stripped fumigant stream.

Preferably the fumigation chamber contains a plurality of small diameter floor and wall-mounted pipes independently connected via an appropriate system of taps and connectors to a fumigant sampling and detection meter unit located in the control room. More preferably the floor and wall-mounted pipes may be further adapted to be located in recessed grooves which may form part of the construction of the walls or floor of the container.

Preferably the control room includes a system control box which contains the fumigant sampling and detection meter unit and power supply switches for mixing fans,

exhaust fan, lights, gas heaters and valve actuators.

In the preferred embodiment of the invention the fumigation apparatus is constructed within a conventional shipping container. Such a container is in all respects suitable for handling and use in the wharf or port vicinity. In fact, if available, effective fumigation of dunnage on site at the wharf by skilled operators would allow for the safe treatment and removal of this material for re-use as firewood or for building purposes, would eliminate the possibility of insects or vermin escaping into the environment, would speed up the fumigation processing rate and would provide some enhanced health and safety benefits.

According to another aspect of the invention there is provided a method of fumigating produce, said method comprising the steps of:

providing a fumigation apparatus including a conventional shipping container which at least in part defines a fumigation chamber;

locating the produce to be fumigated in the fumigation chamber;

providing a flow of a fumigant to the fumigation chamber; and

extracting at least some of the fumigation from said chamber.

Preferably the method of fumigating produce also comprises the step of absorbing at least part of the fumigant extracted from the fumigation chamber. More preferably said fumigant extracted from the chamber is absorbed on an absorption bed.

Typically the method of fumigating produce further comprises washing at least part of the absorption bed to remove the absorbed fumigant. More typically the absorption bed is washed with a scrubbing solution, such as sodium thiosulphate, to yield one or more salts, such as bromide and sodium methylthiosulphate.

Generally the fumigant includes an alkyl halide such as methyl bromide. The produce is usually timber.

Brief Description of the Drawings

Notwithstanding any other forms which may fall within its scope, preferred forms of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 shows a perspective schematic view of a shipping container fitted internally in accordance with one embodiment of the invention with a fumigation chamber and a control room;

Figure 2 is a similar view to Figure 1 showing the flow direction of gas between process units; and

Figure 3 is a perspective schematic view of another embodiment of the fumigation apparatus.

Detailed Description of the Preferred Embodiments

As shown in Figures 1 and 2 there is one embodiment of a fumigation apparatus comprising a conventional shipping container 10, a partition wall 14 dividing the container 10 into a control room 12 and a fumigation chamber 16. The control room 12 contains a heating source 18 and a source of a liquified fumigation reagent 20 both items contained in a storage box 22 secure against the passage of gases. The control room also has a vented door 23 to provide external access. Piping means 24 exist for the supply and distribution of heated fumigant or in this example toxic gases directly to the fumigation chamber 16. Such an arrangement ensures firstly that the heavy toxic gas molecules, for example methyl bromide, are appropriately gasified and dispersed in air for transfer into the fumigation chamber 16. The gas-tight storage box 22 ensures that the toxic gases being fed to the fumigation process will not pose any occupational health risk to operators of the fumigation apparatus while those operators may be standing in the control room 12 during that period when the gas undergoes heating during processing.

The control room 12 contains a system control box 26 which functions to control the flow of toxic gas into the fumigation chamber 16. Such an arrangement ensures that at all times the availability of fumigation gases is able to be manually controlled which ensures that highly safe operating procedures can be maintained.

A nominal number of mixing fans, in this case two fans 28 and 30, circulate gases within the fumigation chamber 16 when operating. Mixing fans such as 28 and 30 located by appropriate wall-mountings on the partition wall 14 dividing the container 10 into a fumigation chamber 16 and a control room 12 would provide sufficient circulation to prevent the toxic gases, which are heavier than air, from only locating in the lower portion of the fumigation chamber 16.

Gas-tight end doors 32 provide access to the fumigation chamber 16 when it is not operating. A sliding bed or floor 34 is included in the container 10 to slide in and out of gas-tight end doors 32. Such an arrangement means that bulk quantities of large individual or odd-shaped pieces of timber and dunnage may be conveniently loaded into the fumigation chamber 16 because of the size of the doors 32 and the access provided by the sliding bed or floor 34. Conventional shipping containers such as 10 have gas-tight end doors 32 which makes them very suitable pieces of equipment in this regard.

Extraction means for evacuation of the fumigation chamber gases includes a pipe 36 attached to an orifice 38 located in the lower region of the partition 14, the pipe 36 in turn connected to an actuated butterfly valve 40 and a contra-rotating fan 42 and thence to a pipe exhaust stack 44. The uppermost terminal of the stack 44 is fitted with a gas diffuser and appropriate rain guard 46. Control of the actuated butterfly valve 40 and contra-rotating fan 42 are by means of system control box 26. Such an arrangement allows the toxic, heavier than air gases to be removed by

fan induced suction from the fumigation chamber 16 at an appropriate lower height, where said gas molecules will naturally congregate without recirculation, followed by dispersion to the external atmosphere via a stack 44 which is of sufficient height to allow the gas contents of the fumigation chamber 16 to be safely vented without occupational health risk exposure to operators or others located nearby the fumigation apparatus.

A plurality of gas sampling lines 48 are mounted on both the walls and floor of the fumigation chamber 16 and connected via an appropriate system of pipes and connectors to a gas flow meter test unit located within system control box 26. Such an arrangement provides a gas sampling system which is connected in use to a gas flow meter test unit which draws small amounts of the gaseous contents of the fumigation chamber 16 and delivers a reading as to the concentration of toxic gas remaining in the fumigation chamber 16 during the venting procedure. This monitoring is carried out to ensure that the main fumigation chamber doors 32 may be safely opened for the purposes of removing the charged timber and dunnage material without occupational health risk exposure to operators or others located nearby the fumigation apparatus.

System control box 26 also includes power supply switches and circuits for operating heating source 18, mixing fans 28 and 30 and, as stated earlier, actuated butterfly valve 40 and contra-rotating fan 42. Interior lights 50 would also be controlled from the system control box 26. Such an arrangement provides a central and securable location for all electrically operated devices, which is important when sequential operational steps are required.

During use, dunnage and timber material for fumigation is loaded onto the sliding floor 34 and then inserted into the fumigation chamber 16 using gas-tight end doors 32 to provide access for the load. The end doors 32 are then

sealed and heated toxic gases, generated by warming liquified fumigation reagent 20 by means of heating source 18, directly enter the fumigation chamber 16 via piping means 24. System control box 26 functions to control the flow of toxic gas into the fumigation chamber. As best illustrated in Figure 2, the mixing fans 28 and 30 circulate gases within the fumigation chamber 16 when in use to provide good mixing of toxic gases with the charged material. When the fumigation interval is complete, the recirculation fans 28 and 30 are switched off, the flow of toxic gas into the chamber 16 is stopped and gas is evacuated from the fumigation chamber 16, flowing consecutively through orifice 38, pipe 36, actuated butterfly valve 40 and contra-rotating fan 42 before exiting the apparatus via pipe exhaust stack 44. As a safety check of the concentration of toxic gases remaining in the fumigation chamber 16, gas samples are drawn via a plurality of the gas sampling lines 48 to a gas flow meter test unit located within system control box 26 and a readout is obtained so that the operator may ascertain when it is safe to reopen end doors 32 and remove the dunnage and timber material from the sliding floor 34 after fumigation. At this point the apparatus is ready for a new load of material for fumigation and a repeat procedure.

Figure 3 depicts another embodiment of the fumigation apparatus including a pair of conventional forty (40) foot shipping containers 100A and 100B located alongside one another. In this particular construction of the invention the control room 120 is formed from a twenty (20) foot shipping container 130 located alongside adjacent ends of the forty (40) foot shipping containers 100A/B. In order to avoid repetition and for ease of reference similar components and features of this alternative embodiment of the invention has been designated with an additional "0", such as the control room 120.

In this other embodiment of Figure 3 the fumigation

apparatus includes absorption means in the form of an absorption bed such as 150 located downstream of the valve 400. The absorption bed 150 includes activated carbon to which the fumigant, in this example methyl bromide, attaches or is absorbed and is thus stripped from the gas/fumigant extracted from the fumigation chamber such as 160. Otherwise the extraction means is similar in construction to the preceding example of the fumigation apparatus.

The control room 120 of the twenty (20) foot container 130 is provided with the heating source or heat exchanger 180 and the source of fumigant, in this embodiment liquified methyl bromide. The piping means (not shown) which is located in a ceiling of each of the fumigation chambers such as 160 is operatively coupled to the heating source 180 and liquified fumigation reagent source 200.

The methyl bromide attaches to the activated carbon of the absorption bed 150 prior to discharge of the fumigant/gas mixture from the fumigation apparatus. The absorption bed 150 is periodically washed with a scrubbing solution, such as sodium thiosulphate. In this embodiment scrubbing of the absorption bed 150 with sodium thiosulphate yields bromide and sodium methylthiosulphate which are non-toxic salts which can be discharged safely to the environment. Thus, the methyl bromide gas is degraded following its fumigation and then extraction from the fumigation apparatus.

Now that several preferred embodiments of the present invention have been described in some detail it would be apparent to those skilled in the art that the fumigation apparatus has at least the following advantages over the admitted prior art;

1. The fumigation apparatus is adapted from a conventional shipping container and thus is relatively convenient and uncomplicated to fabricate;

2. The fumigation apparatus is relatively effective

in fumigating produce; and

3. The fumigation apparatus is "environmentally friendly" in its fumigation and discharge of the fumigant.

Those skilled in the art will appreciate that the invention described herein is susceptible to variations and modifications other than those specifically described. For example, the source of fumigant need not be located in the fumigation apparatus but rather may be mounted on a mobile vehicle such as a utility truck. The invention need not be restricted to methyl bromide as the fumigant but rather extends to any substance which is suitable in fumigating produce and thus killing pests, parasites, insects, or vermin. The invention need not be restricted to the specific constructional features described and may for example not include the sliding bed or floor.

All such variations and modifications are to be considered within the scope of the present invention the nature of which is to be determined from the foregoing description.

The claims defining the invention are as follows:

1. A fumigation apparatus comprising:

a conventional shipping container which at least in part defines a fumigation chamber being adapted to contain produce to be fumigated;

fumigant inlet means operatively coupled to the container to allow a flow of a fumigant into the fumigation chamber; and

extraction means also being operatively coupled to the container to remove a majority of the fumigant from the fumigation chamber.

2. A fumigation apparatus as defined in claim 1 further comprising control means operatively coupled to the shipping container and arranged to control the flow of fumigant into said container.

3. A fumigation apparatus as defined in claim 1 or 2 also comprising another conventional shipping container positioned alongside the shipping container and providing a control room in which the control means is located.

4. A fumigation apparatus as defined in claim 1 or 2 further comprising a partition wall dividing the shipping container into the fumigation chamber and a control room in which the control means is located.

5. A fumigation apparatus as defined in any one of the preceding claims further comprising absorption means operatively coupled to the extraction means, said absorption means being designed to absorb at least part of the fumigant extracted from the fumigation chamber.

6. A fumigation apparatus as defined in claim 5 wherein said absorption means comprises an absorption bed including

activated carbon to which at least part of the extracted fumigant attaches.

7. A fumigation apparatus as defined in any one of the preceding claims also comprises a sliding bed or floor on which the produce resides, said bed or floor being configured to slide into and out of the fumigation chamber wherein loading and unloading of the produce to be fumigated can be performed externally of said chamber.

8. A fumigation apparatus as defined in any one of the preceding claims wherein the control room incorporates a source of the fumigant which is directly associated with a heating source, the latter used to convert the fumigant into a gaseous form.

9. A fumigation apparatus as defined in any one of claims 1 to 7 wherein the fumigant inlet means is adapted to detachably couple to a mobile source of the fumigant.

10. A fumigation apparatus as defined in claim 3 or 4 wherein the control room incorporates a system control box and a system of fumigant delivery pipes and valves adapted in use to supply fumigant from a supply source to the fumigation chamber.

11. A fumigation apparatus as defined in claim 7 wherein the fumigation chamber has openable doors in the container, the end doors when closed being secure against the passage of fumigant and further being fitted with external locking cam devices adapted to be secured with a latch and pin arrangement.

12. A fumigation apparatus as defined in claim 11 wherein the sliding bed or floor of the fumigation apparatus facilitates loading and removal of produce for fumigation

via the end doors.

13. A fumigation apparatus as defined in any one of the preceding claims wherein the fumigant inlet means includes a dispersion pipe system located in the upper part of the fumigation chamber.

14. A fumigation apparatus as defined in any one of the preceding claims wherein the fumigation chamber is provided with a plurality of mixing fans adapted to circulate fumigant and gases within the chamber.

15. A fumigation apparatus as defined in any one of the preceding claims wherein the extraction means includes a pipe attached to an orifice located in a lower region of a partition or a container wall, the pipe being connected in turn to an actuated butterfly valve further connected in turn to a contra-rotating fan adapted to provide suction for the extraction of the fumigant.

16. A fumigation apparatus as defined in claim 16 wherein the extraction means includes an exhaust stack positioned vertically above the fumigation container, the uppermost terminal of the exhaust stack being fitted with a gas diffuser and appropriate rain guard, and the exhaust stack being arranged to receive the stripped fumigant stream.

17. A fumigation apparatus as defined in any one of the preceding claims wherein the fumigation chamber contains a plurality of small diameter floor and wall-mounted pipes independently connected via an appropriate system of taps and connectors to a fumigant sampling and detection meter unit located in the control room.

18. A fumigation apparatus as defined in claim 3 or 4 wherein the control room includes a system control box

which contains a fumigant sampling and detection meter unit and power supply switches for mixing fans, exhaust fan, lights, gas heaters and valve actuators.

19. A method of fumigating produce, said method comprising the steps of:

providing a fumigation apparatus including a conventional shipping container which at least in part defines a fumigation chamber;

locating the produce to be fumigated in the fumigation chamber;

providing a flow of a fumigant to the fumigation chamber; and

extracting at least some of the fumigation from said chamber.

20. A method of fumigating produce as defined in claim 18 also comprising the step of absorbing at least part of the fumigant extracted from the fumigation chamber.

21. A method of fumigating produce as defined in claim 19 wherein said fumigant extracted from the chamber is absorbed on an absorption bed.

22. A method of fumigating produce as defined in claim 19 or 20 further comprising washing at least part of the absorption bed to remove the absorbed fumigant.

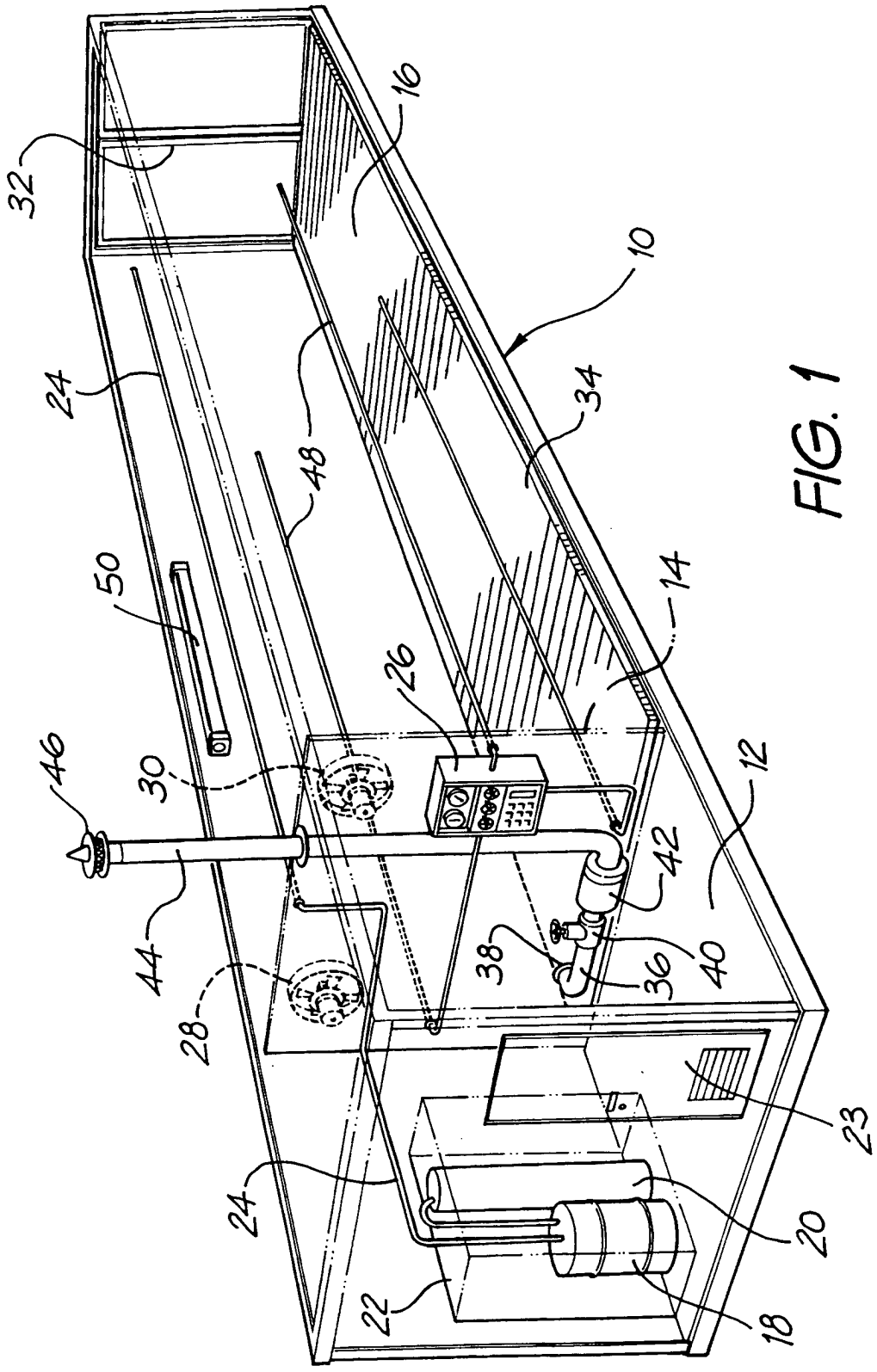


FIG. 1

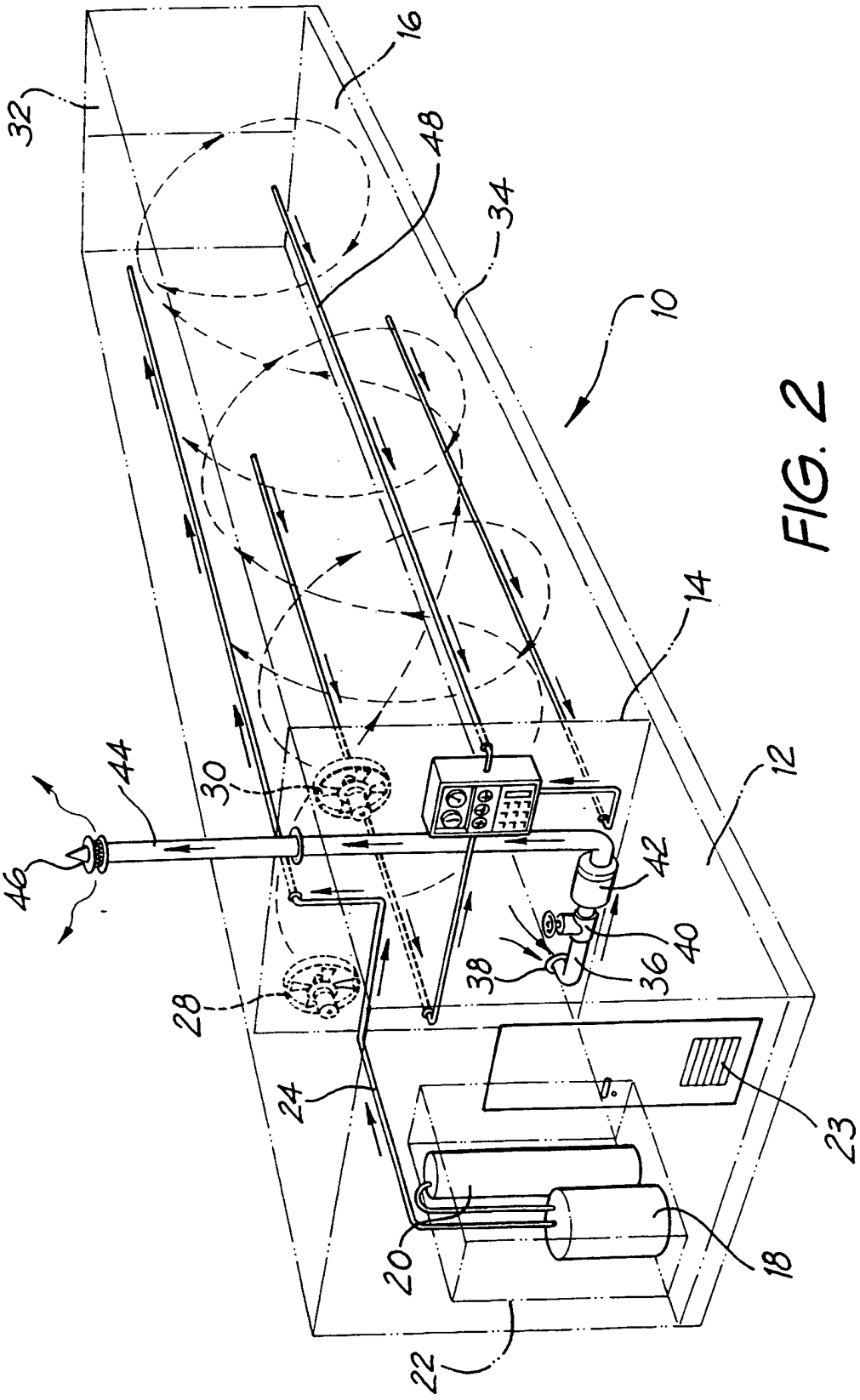


FIG. 2

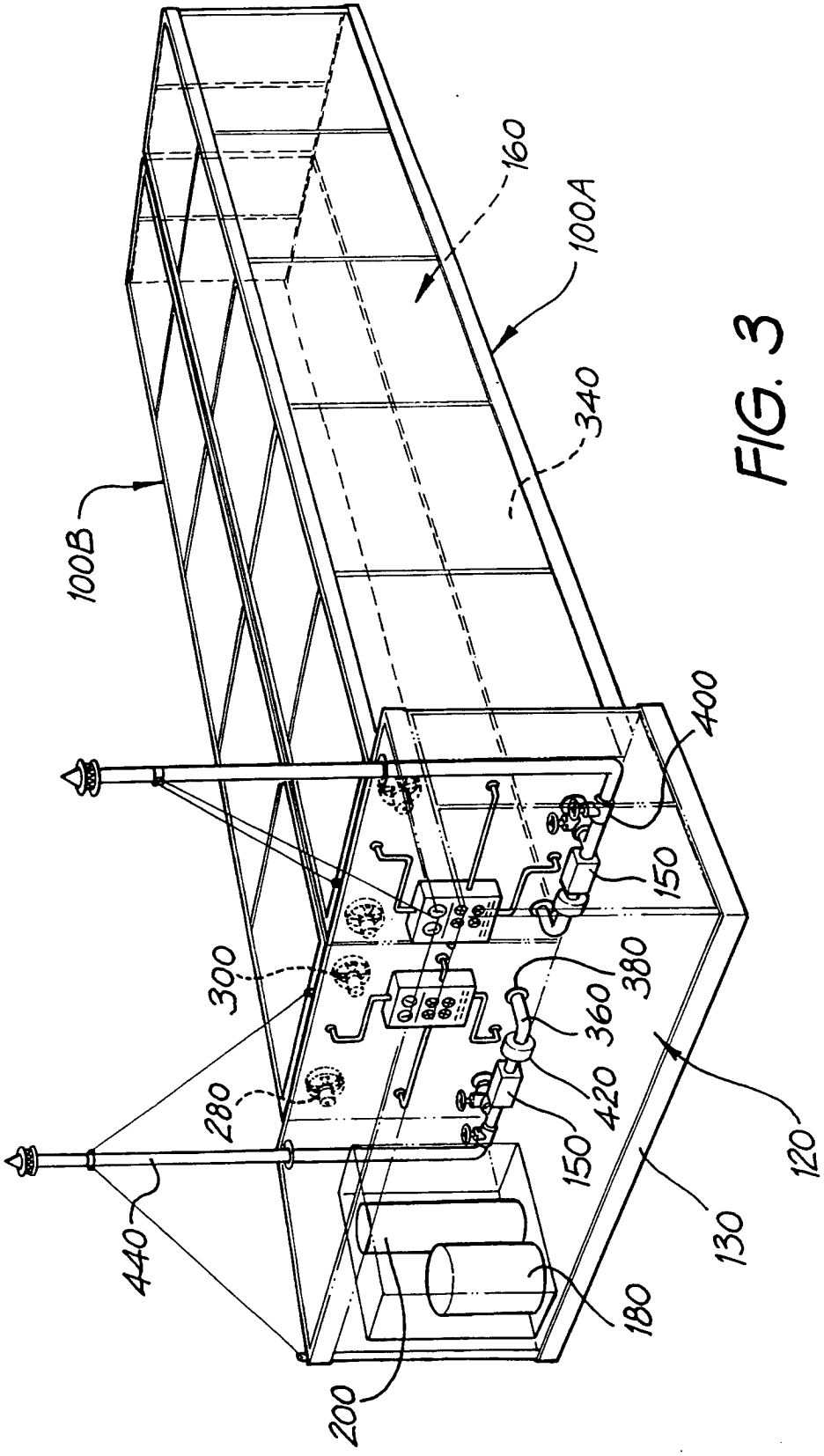

160
100A
340
100B
400
150
300
380
360
420
280
150
120
440
130
180
200

FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU00/00336

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. [7]: A01M 13/00, B65D 88/74

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: A01M 13/00, B65D 88/74

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
DERWENT
US, EP, JP DATABASES

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 5318789 (NAKAGAWA et al) 7 June 1994 Entire document	1-4,7-19 5,6,20-22
X Y	JP 08322449 A (ISHIKAWAJIMA HARIMA) 10 December 1996 Abstract	1-4,7-19 5,6,20-22
X Y	Patents Abstracts of Japan, JP, 02303442 A (HITACHI) 17 December 1990 Abstract	1-4,7-10,12-16,18, 19 5,6,20-22

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
5 May 2000

Date of mailing of the international search report
23 MAY 2000

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU00/00336

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Patent Abstracts of Japan, JP, 02013341 A (C CONTAINER- ZU) 17 January 1990 Abstract	1-4,7-9,12-15,18,19
Y		5,6,20-22
Y	AU 32801/95 A (DEGESCH) 4 April 1996 Page 13, 5th paragraph 2nd line; Page 17, 4th paragraph; Page 19, 2nd last line-Page 20, 2nd line Note: The last document can be combined with any one of the other documents	5,6,20-22

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/AU00/00336

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Member			
US 5318789	US 5312034			
AU 32801/95	EP 702895	JP 8103211	PL 310615	

END OF ANNEX

RECT 30 MAY 2001 (22 MAY 2001)
WIPO PCT

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

14

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference FP12653	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International Application No. **PCT/AU00/00336**	International Filing Date *(day/month/year)* 19 April 2000	Priority Date *(day/month/year)* 20 April 1999
International Patent Classification (IPC) or national classification and IPC **Int. Cl.** [7] A01M 13/00, B65D 88/74		
Applicant AUSTRALIAN SHIPPING LOGISTICS PTY LTD et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

 [X] This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

 These annexes consist of a total of **9** sheet(s).

3. This report contains indications relating to the following items:

I	[X]	Basis of the report
II	[]	Priority
III	[]	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	[]	Lack of unity of invention
V	[X]	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI	[]	Certain documents cited
VII	[]	Certain defects in the international application
VIII	[]	Certain observations on the international application

Date of submission of the demand 20 November 2000	Date of completion of the report 11 May 2001
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer **A. SEN** Telephone No. (02) 6283 2158

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/AU00/00336

I. Basis of the report

1. With regard to the **elements** of the international application:*

☐ the international application as originally filed.

☒ the description, pages **1, 6-11,** as originally filed,
page **2,** received on **2 May 2001** with the letter of **5 April 2001**
pages **3-5, 5A,** received on **30 January 2001** with the letter of **30 January 2001**

☒ the claims, pages , as originally filed,
pages , as amended (together with any statement) under Article 19,
pages **12,** received on **2 May 2001** with the letter of **5 April 2001,**
pages **13-15,** received on **30 January 2001** with the letter of **30 January 2001**

☒ the drawings, pages **1/3-3/3,** as originally filed,
pages , filed with the demand,
pages , received on with the letter of

☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, was on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages

☐ the claims, Nos.

☐ the drawings, sheets/fig.

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report*

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims **1-15**	**YES**
	Claims	**NO**
Inventive step (IS)	Claims **1-15**	**YES**
	Claims	**NO**
Industrial applicability (IA)	Claims **1-15**	**YES**
	Claims	**NO**

2. Citations and explanations (Rule 70.7)

Claims 1-15 meet the criteria set forth in PCT Article 33(2)-33(4) for novelty, inventive step and industrial applicability. The prior art published before the priority date does not disclose a fumigation apparatus consisting of a conventional shipping container defining a fumigation chamber and a mobile fumigation means coupled to the container and including a fumigant inlet means, an extraction means and an absorption means.

fumigation. The vented fruit containers are stacked in a purpose-built fumigation chamber of a fumigation facility and the fruit fumigated with a gaseous fumigant. The fruit containers are then transported out of the fumigation facility either to a cold storage area of a packing house or directly to shipment vehicles.

Summary of the Invention

According to one aspect of the present invention there is provided a fumigation apparatus including:

a conventional shipping container which at least in part defines a fumigation chamber being adapted to contain produce to be fumigated, and

mobile fumigation means operatively coupled to the conventional shipping container, the mobile fumigation means including:

fumigant inlet means operatively coupled to the container to allow a flow of a fumigant into the fumigation chamber;

extraction means also being operatively coupled to the container to remove a majority of the fumigant from the fumigation chamber; and

absorption means being operatively coupled to the extraction means, the absorption means being designed to absorb substantially all of the fumigant extracted from the fumigation chamber.

Preferably the mobile fumigation means is defined by a shipping container. Typically the fumigation chamber is a pair of shipping containers positioned alongside one another each operatively coupled to the mobile fumigation means. Alternatively the mobile fumigation means is defined by a partition wall in the shipping container, the wall separating the mobile fumigation means and the fumigation chamber.

Preferably the fumigation apparatus further includes control means operatively coupled to the shipping container and arranged to control the flow of fumigant into the

container. Typically the mobile fumigation means is a control room in which the control means is located.

Preferably the partition wall and/or the shipping container fumigation chamber itself is secure against the passage of the fumigant. This means that toxic gases from the process in the fumigation chamber will not pose any occupational health risk to operators of the fumigation apparatus during processing, while they may be standing in the adjacent control room. It also provides an all weather secure location for associated control equipment.

Preferably the absorption means comprises an absorption bed including activated carbon to which at least part of the extracted fumigant attaches.

Typically the fumigation apparatus also comprises a sliding bed or floor on which the produce resides, said bed or floor being configured to slide into and out of the fumigation chamber wherein loading and unloading of the produce to be fumigated can be performed externally of said chamber.

Preferably the control room incorporates a source of the fumigant which is preferably directly associated with a heating source, the latter used to convert the fumigant into a gaseous form. The heat energy transferred to the fumigant should be such that it becomes more buoyant than ambient air. In another variant the fumigation apparatus has a source of the fumigant and a heating source which are contained in an appropriate storage box which is secure against the passage of gases. Alternatively the fumigant inlet means is adapted to detachably couple to a mobile source of the fumigant such as a motor vehicle on which a fumigant vessel is mounted.

Preferably the control room incorporates a system control box and a system of fumigant delivery pipes and valves adapted in use to supply fumigant from the supply source to the fumigation chamber.

Preferably the fumigation chamber has openable doors

in the container, the end doors when closed being secure against the passage of fumigant and further being fitted with external locking cam devices adapted to be secured with a latch and pin arrangement. More preferably the sliding bed or floor of the fumigation apparatus facilitates loading and removal of produce for fumigation via the end doors.

Preferably the fumigant inlet means includes a dispersion pipe system located in the upper part of the fumigation chamber. Such an arrangement allows the fumigant, which is generally heavier than air, to fall in a dispersed fashion downward over the top of the produce such as the timber and dunnage charge which has been loaded into the fumigation chamber.

Preferably the fumigation chamber is provided with a plurality of mixing fans adapted to circulate fumigant and gases within the chamber. Such an arrangement allows more even and thorough dispersion of the fumigant and gases as they enter and are dispersed in the fumigation chamber.

Preferably the extraction means includes a pipe attached to an orifice located in a lower region of a partition or a container wall, the pipe being connected in turn to an actuated butterfly valve further connected in turn to a contra-rotating fan adapted to provide suction for the extraction of the fumigant. More preferably the extraction means includes an exhaust stack positioned vertically above the fumigation container, the uppermost terminal of the exhaust stack being fitted with a gas diffuser and appropriate rain guard, and the exhaust stack being arranged to receive the stripped fumigant stream.

Preferably the fumigation chamber contains a plurality of small diameter floor and wall-mounted pipes independently connected via an appropriate system of taps and connectors to a fumigant sampling and detection meter unit located in the control room. More preferably the floor and wall-mounted pipes may be further adapted to be

located in recessed grooves which may form part of the construction of the walls or floor of the container.

Preferably the control room includes a system control box which contains the fumigant sampling and detection meter unit and power supply switches for mixing fans, exhaust fan, lights, gas heaters and valve actuators.

In the preferred embodiment of the invention the fumigation apparatus is constructed using at least one conventional shipping container. Such a container is in all respects suitable for handling and use in the wharf or port vicinity. In fact, if available, effective fumigation of dunnage on site at the wharf by skilled operators would allow for the safe treatment and removal of this material for re-use as firewood or for building purposes, would eliminate the possibility of insects or vermin escaping into the environment, would speed up the fumigation processing rate and would provide some enhanced health and safety benefits.

According to another aspect of the invention there is provided a method of fumigating produce, the method comprising the steps of:

providing a fumigation apparatus including a conventional shipping container which at least in part defines a fumigation chamber and a mobile fumigation means operatively coupled to the container;

locating the produce to be fumigated in the fumigation chamber;

providing a flow of a fumigant to the fumigation chamber;

extracting at least some of the fumigation from the chamber; and

absorbing at least part of the fumigant extracted from the fumigation chamber.

Preferably the fumigant extracted from the chamber is absorbed on an absorption bed.

Typically the method of fumigating produce further

comprises washing at least part of the absorption bed to remove the absorbed fumigant. More typically the absorption bed is washed with a scrubbing solution, such as sodium thiosulphate, to yield one or more salts, such as bromide and sodium methylthiosulphate.

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Received 02 May 2001

The claims defining the invention are as follows:

1. A fumigation apparatus including:

a conventional shipping container which at least in part defines a fumigation chamber being adapted to contain produce to be fumigated, and

mobile fumigation means operatively coupled to the conventional shipping container, the mobile fumigation means including:

fumigant inlet means operatively coupled to the container to allow a flow of a fumigant into the fumigation chamber;

extraction means also being operatively coupled to the container to remove a majority of the fumigant from the fumigation chamber; and

absorption means being operatively coupled to the extraction means, the absorption means being designed to absorb substantially all of the fumigant extracted from the fumigation chamber.

2. A fumigation apparatus as defined in claim 1 wherein the mobile fumigation means is defined by a shipping container.

3. A fumigation apparatus as defined in claim 1 or 2 wherein the fumigation chamber is a pair of shipping containers positioned alongside one another each operatively coupled to the mobile fumigation means.

4. A fumigation apparatus as defined in claim 1 wherein the mobile fumigation means is defined by a partition wall in the shipping container, the wall separating the mobile fumigation means and the fumigation chamber.

AMENDED SHEET
IPEA/AU

5. A fumigation apparatus as defined in any one of the preceding claims wherein the absorption means comprises an absorption bed including activated carbon to which at least part of the extracted fumigant attaches.

6. A fumigation apparatus as defined in any one of the preceding claims also including a sliding bed or floor on which the produce resides, the bed or floor being configured to slide into and out of the fumigation chamber wherein loading and unloading of the produce to be fumigated can be performed externally of the chamber.

7. A fumigation apparatus as defined in any one of the preceding claims wherein the mobile fumigation means incorporates a source of the fumigant which is directly associated with a heating source, the latter used to convert the fumigant into a gaseous form.

8. A fumigation apparatus as defined in any one of claims 1 to 6 wherein the fumigant inlet means is adapted to detachably couple to a mobile source of the fumigant.

9. A fumigation apparatus as defined in any one of the preceding claims wherein the mobile fumigation means incorporates a system control box and a system of fumigant delivery pipes and valves adapted in use to supply fumigant from a supply source to the fumigation chamber.

10. A fumigation apparatus as defined in any one of the preceding claims wherein the fumigant inlet means includes a dispersion pipe system located in the upper part of the fumigation chamber.

11. A fumigation apparatus as defined in any one of the preceding claims wherein the fumigation chamber contains a plurality of small diameter floor and wall-mounted pipes independently connected via an appropriate system of taps and connectors to a fumigant sampling and detection meter unit located in the control room.

12. A fumigation apparatus as defined in claims 9 to 11 wherein the system control box contains a fumigant sampling and detection meter unit and power supply switches for mixing fans, exhaust fan, lights, gas heaters and valve actuators.

13. A method of fumigating produce, the method comprising the steps of:

providing a fumigation apparatus including a conventional shipping container which at least in part defines a fumigation chamber and a mobile fumigation means operatively coupled to the container;

locating the produce to be fumigated in the fumigation chamber;

providing a flow of a fumigant to the fumigation chamber;

extracting at least some of the fumigation from the chamber; and

absorbing at least part of the fumigant extracted from the fumigation chamber.

14. A method of fumigating produce as defined in claim 13 wherein the fumigant extracted from the chamber is absorbed on an absorption bed.

15. A method of fumigating produce as defined in claim 13 or 14 further comprising washing at least part of the absorption bed to remove the absorbed fumigant.

5

P. .ENT COOPERATION TREA.

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark Office, PCT
2011 South Clark Place Room CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 01 December 2000 (01.12.00)	
International application No. PCT/AU00/00336	**Applicant's or agent's file reference** FP12653
International filing date (day/month/year) 19 April 2000 (19.04.00)	**Priority date** (day/month/year) 20 April 1999 (20.04.99)
Applicant BRASH, Kenneth, George	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

20 November 2000 (20.11.00)

[] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer F. Baechler
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

Form PCT/IB/331 (July 1992)

AU0000336

P. . ENT COOPERATION TREA.

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

GRIFFITH HACK
GPO Box 4164
Sydney, NSW 2001
AUSTRALIE

Date of mailing (day/month/year)
23 October 2001 (23.10.01)

Applicant's or agent's file reference
FP12653

IMPORTANT NOTIFICATION

International application No.
PCT/AU00/00336

International filing date (day/month/year)
19 April 2000 (19.04.00)

1. The following indications appeared on record concerning:

[X] the applicant [] the inventor [] the agent [] the common representative

Name and Address
AUSTRALIAN SHIPPING LOGISTICS PTY LTD
Suite 9
Floor 1
401 Pacific Highway
Artarmon, NSW 2064
Australia

State of Nationality: AU
State of Residence: AU
Telephone No.: 9906 5552
Facsimile No.: 9906 1874
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[] the person [X] the name [] the address [] the nationality [] the residence

Name and Address
ASIAWORLD SHIPPING SERVICES PTY LTD
Suite 9
Floor 1
401 Pacific Highway
Artarmon, NSW 2064
Australia

State of Nationality: AU
State of Residence: AU
Telephone No.: 9906 5552
Facsimile No.: 9906 1874
Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[] the International Searching Authority
[] the International Preliminary Examining Authority
[] the designated Offices concerned
[X] the elected Offices concerned
[] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

Authorized officer
Paulette BOCCARD (Fax 338.87.40)
Telephone No.: (41-22) 338.83.38